other aspects of morphogenesis. These data reveal molecular details of novel pathways underlying long-range information transfer during embryonic development and regeneration. Moreover, the preliminary data point towards potential new therapeutic modalities for altering cell proliferation, differentiation, and migration.

doi:10.1016/j.ydbio.2006.04.036

26
The role of Caudal transcription factors during segmentation of the nervous system and paraxial mesoderm

Robert K. Ho, Isaac Skromne
University of Chicago, Chicago, IL, USA

The segmental nature of the embryo is most evident within the paraxial mesoderm during the formation of somites and within the nervous system during the formation of hindbrain rhombomeres. Classic and modern embryological experiments show that the posterior neural plate gives rise to the hindbrain and spinal cord portions of the central nervous system. Then, the hindbrain is subdivided into neuromeres that are required for proper structural patterning of the adult brain stem while the spinal cord remains unsegmented, although able to receive signaling cues from the adjacent mesoderm to organize its neuronal populations into an iterative pattern. What sets up the difference between segmented and unsegmented regions? Here, we use genetic and molecular approaches in zebrafish to address the mechanisms involved in the determination of the hindbrain and spinal cord regions from a common posterior neural plate territory. In all species studied so far, including zebrafish, members of the Caudal (Cdx) family of homeobox transcription factors are required for proper development of the most posterior regions of the embryo. We examined hindbrain and spinal cord neuronal populations in zebrafish embryos lacking cdx1a and cdx4 activities. Single cdx1a or cdx4 depleted embryos show mild shifts in the distribution of these neuronal populations. In contrast, double cdx1a/cdx4-deficient embryos display the presence of hindbrain neuronal populations throughout the trunk and tail of the animal and the absence of spinal cord-specific neuronal markers. In addition, hox expression analysis in double mutants reveals the presence of extra neuromeres that are arranged in a mirror image duplication pattern to the native hindbrain segments. Our data suggest that members of the Cdx family of homeobox transcription factors are required to suppress segmentation of the posterior portion of the neural plate and thus allow the development of the spinal cord. We further suggest that a common mechanism involving cdx genes may play a role in the segmentation of both the nervous system and the paraxial mesoderm.

doi:10.1016/j.ydbio.2006.04.037

27
Zebrafish lacking a functional dispatched 1 display variable craniofacial anomalies in part due to defects in neural crest cell morphogenesis

Sara Ahlgren [2], Tyler Schwend [1]
[1] *Northwestern University School of Medicine, Chicago IL, USA*
[2] *Children's Memorial Research Center, Chicago IL, USA*

The vertebrate head skeleton is primarily derived from cranial neural crest cells (CNCC). These CNCCs migrate and interact with surrounding mesenchyme and endoderm to build the skull. The loss of Hedgehog (Hh) signaling in the vertebrate embryo causes severe craniofacial defects, in part due to defects in CNCC-derived tissues. Inactivation of zebrafish Hh family members shhA and twhh (shhB) leads to variable midline defects and reduced chondrogenesis in the developing anteriocranium. Such variation in craniofacial midline defects is characteristic of the Hh-associated disorder holoprosencephaly in humans. Dispatched 1 is a 12 transmembrane domain protein involved in the release of shh. We have demonstrated that zebrafish chameleon (con) mutant embryos, lacking functional dispatched 1 protein, display variable defective craniofacial patterning throughout the midline and exhibit an overall reduction in chondrogenesis. These results further suggest an Hh requirement by CNCC in the development of the vertebrate skull. Using in situ hybridization for neural crest-specific markers, we will examine the induction of neural crest cells and their migratory patterns in dispatched 1 mutants. Further, zebrafish carry a second dispatched protein, dispatched 2, whose potential role in Hh signaling has yet to be determined. We will characterize any craniofacial abnormalities in dispatched 2 morphants and combination morphants defective in all dispatched signaling in order to further understand the role of Hh and dispatched proteins in vertebrate head skeleton development.

doi:10.1016/j.ydbio.2006.04.038